

Department of Entomology
Texas A&M University

Ninth Annual
Graduate Student Forum



Tuesday, August 22, 2006
Minnie Belle Heep Center, Room 103

**Texas A&M University Department of Entomology
Ninth Annual Graduate Student Forum**

Committee Members

Dr. Patricia Pietrantonio, Chair
 Dr. Jim Olson
 Dr. Craig Coates
 Chair Assistant: Teresa Gold

Dr. Raul Medina
 Dr. Keyan Zhu-Salzman
 Robert Puckett
 Co-Chair Assistant: Laci McKnight

Evaluators

Dr. Ginger Carney
 Assistant Professor
 Department of Biology

Dr. Frances Gelwick
 Associate Professor
 Department of Wildlife and Fisheries

Dr. Tanya Pankiw
 Assistant Professor
 Department of Entomology

Dr. Jim Woolley
 Professor
 Department of Entomology

Graduate Student Forum Previous Award Recipients

Year	1 st	2 nd	3 rd
2005	Sonia Kjos	Robert Puckett	Jiri Hulcr
2004	Darren Hagen	Jeremy Hudgeons	Michael (Walker) Hale
2003	Mei-Er Chen	Andrea Julian	Jared Burks
2002	Mei-Er Chen	Christine E. Gray	Steven P. Holmes
2001 (Three way tie)	Christine E. Gray (Three way tie)	Steven P. Holmes (Three way tie)	Ronald D. Weeks (Three way tie)
2000	Jarrad Prasifka	Robert Kula	Ahmed Mohammed
1999	Carlos Bogran	Jarrad Prasifka	Karol Burns
1998	Carlos Bogran	Richard Houseman	Jim Martin

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Reflections from the Chair



Patricia V. Pietrantonio

Associate Professor - Insect Toxicology
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This is, believe it or not, our 9th Graduate Student Forum. It has been a true privilege to chair this committee and I am grateful to all the people that supported and continue to support this event. I have decided that is perhaps wise now to “pass the torch” to a junior faculty who could infuse new energy and perhaps introduce changes to the forum.

I am grateful first to Dr. Ray Frisbie who supported my proposal for the forum and similarly to the students that presented year after year, raising the bar continuously.

Thanks to Dr. Kevin Heinz for continuing the support of the forum upon becoming Department Head, and for providing the continuous support of Ms. Teresa Gold and staff in the main office who make all look effortless. Thanks to Drs. Craig Coates, Jim Olson, Jim Woolley, and Keyan Zhu-Salzman for support as committee members. Thanks to the faculty for encouraging your students, for attending presentations and for volunteer time as judges.

Dr. Raul Medina will be the next chair, and this year he co-Chaired with me by bringing us our invited speaker, Dr. C. Stanley. He also selected an impressive and diverse panel of judges.

Please join me in welcoming Dr. Raul Medina as the next Forum Chair and provide him with the same support and enthusiasm for the forum as you have done so far.

I will miss “this baby” but it is time to let go...Thank you all!

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Keynote Speaker



Dr. Christine Stanley
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Christine Stanley, Associate Dean of Faculties and Associate Professor of Higher Education Administration in the Department of Educational Administration and Human Resource Development, recently published an edited book titled "Faculty of Color: Teaching in Predominantly White Colleges and Universities." Stanley, a native of Jamaica, West Indies, said that the featured authors are all professors of color who have overcome adversity and are excelling in academia. "This is a call for all of us to engage in deeper dialogues and learn from these experiences so that colleges and universities can be a welcoming place for everyone seated at the table," Stanley said. Each chapter provides a discussion forum on the experiences of faculty of color teaching in mostly white institutions as well as narratives from those experiences that provide helpful strategies for recruitment and retention. Experiences extend beyond teaching and include research, mentoring, administration, recruitment, institutional climate, and relationships with students and colleagues. "The book offers a variety of recommendations so that predominantly white colleges and universities can continue working to ensure that institutions change in substantive ways," Stanley said. "The challenge for anyone reading this book is not only to understand the experiences shared, but to work toward developing effective strategies for the recruitment and retention of faculty of color in higher education."

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Department Head



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The 2006 Entomology Graduate Student Forum showcases new knowledge that illuminates the discipline of Entomology from many diverse perspectives. Because of the universality of insects, embedded within Entomology are diverse scientific, geographic and cultural entities that provide a foundation upon which graduate student and their mentors create knowledge that will affect the lives of others. Their new scientific discoveries and contributions in solving problems through goal oriented research are invaluable to improving the human condition. Today fourteen of the Department's graduate students will illuminate for you a new perspective on Entomology by sharing their latest research discoveries; and as a result they will likely change an attitude, perspective, or understanding of the world around us.

The value of a scientific discovery is often judged over time on the significance and breadth of positive change exerted on various disciplines or people's lives. The lasting effects of discovery are tested through careful design and replication of scientific experiments, with a purpose being to assess sources of variation that have and continue to significantly influence a particular discovery. Experiments often include multiple genes, biochemical pathways, species, habitats, geographical regions, or disciplines, and they are often conducted over time. The use of replication and appropriate statistics test hypotheses of occurrence due to change versus causation. Embracing diversity is a prerequisite to the success of science, and to graduate students and mentors being successful scientists.

The 2006 Entomology Annual Graduate Student Forum is a showcase of student imagination, initiative, intellect, and dedication. In listening to the various presentations, continue to appreciate the diversity of our discipline and how its diversity adds strength to the science and abilities to positively affect the lives of others.

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Associate Department Head for Academics



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The Annual Graduate Student Forum is a terrific showcase of graduate student research achievements. The forum provides a glimpse of the outstanding quality and excellence of our current graduate students and allows incoming graduate students the opportunity to gain perspectives of a diversity of research topics and to assess the high expectations we have of all of our students.

Graduates of our programs distinguish themselves in leadership roles and achievements at state, national and international levels and in all entomological venues. From teaching, research and extension, to public and private enterprises, to professional school admissions, our former students continue to be in high demand and bring positive recognition to our department.

Twelve new graduate students will be joining the department this September and they will be immersed in university and departmental orientation activities in preparation for the fall semester. Please join me in welcoming these students to our department as we learn about and celebrate the achievements of our current students through the forum.

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Hsiao-Ling Lu

Major Professor: Dr. Patricia Pietrantonio

Ph.D. Candidate

“Developing an antibody against the vitellogenin receptor from the red imported fire ant, *Solenopsis invicta*, Buren. “

The red imported fire ant, *Solenopsis invicta* Buren, is an important pest species due to its high reproductive rate, significant risk to human health and negative impact on agriculture. Understanding the mechanism of oogenesis could provide means to regulate ant reproduction. One of the important events of oogenesis is incorporation of the extra-ovarian yolk protein precursor, the vitellogenin, into the oocyte through vitellogenin receptor (VgR)-mediated endocytosis. Previous studies in our laboratory have shown that the transcript of VgR in the red imported fire ant (*SiVgR*) is present in virgin females of all ages and increased with age. However, the distribution and regulation of *SiVgR* protein, which transports vitellogenin into the oocyte, has not been studied. In order to analyze the spatial and temporal expression pattern of the *SiVgR* protein, we propose to develop a polyclonal antibody against *SiVgR*. After Clustal alignment of different insect VgRs, a highly variable region of *SiVgR* from amino acid position 648 to 887 was chosen as an antigen to develop a polyclonal antibody. The 720bp DNA fragment, (corresponding to amino acids 648 to 887), was PCR amplified from the plasmid containing the receptor clone pVgR2.3-4, and cloned into the pET-32(a) expression vector to generate a partial *SiVgR* protein with an N-terminal extension of the Trx-, His-, and S-tag fusion proteins. As constructed, this plasmid was named pET32a-*SiVgR*. This construct was transformed into *E. coli* strain BL21(DE3) and expression of a fusion protein of approximately 44-kDa was induced by isopropyl-beta-D-thiogalactopyranoside (IPTG). The 44-kDa fusion protein will be purified by metal affinity chromatography and cleaved to remove the protein tag by enterokinase. The purified and cleaved protein will be injected into rabbits as an antigen to raise antibodies against *SiVgR*. The expression patterns of *SiVgR* in virgin and mated queens will be investigated with this antibody using western blot and immunohistochemistry methods.

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Freder Medina

Major Professors: Drs. Bradleigh Vinson and Craig Coates
Ph.D. Candidate

“Bacterial microbiology of the red imported fire ant (*Solenopsis invicta* Büren) midgut.”

The role of bacterial endosymbionts in insects has been associated with several physiological processes, including digestion. Development of new molecular tools has allowed the discovery of microorganisms that manipulate insect reproduction, development, and even provide defense against parasitoids and pathogens. In this study we investigated the presence of bacteria inside the red imported fire ant (*Solenopsis invicta*) midgut using two different methods. First, we captured images using Transmission Electron Microscopy (TEM) and second, we isolated and cultured the microorganisms for molecular analysis. The small-subunit ribosomal RNA gene was amplified from bacterial genomic DNA using the Polymerase Chain Reaction (PCR) and consensus sequence primers. Restriction Fragment Length Polymorphism (RFLP) analysis revealed ten unique profiles. These isolates were identified to at least the genus level when queried against the NCBI database. Three of the strains were genetically modified with the plasmid vector pZeoDsRed and successfully reintroduced into fire ant colonies. Strong fluorescence of DsRed was detected throughout the larval stage (up to seven days after introduction). The transformed bacteria can still be rescued after pupal emergence; however most were passed out in the meconium. We further demonstrated that nurses contribute to the spread of the engineered bacteria within the colony by feeding the meconium to naive larvae. The role of these bacteria is being investigated by measuring the effects on the larvae and colony following antibiotic treatment. Molecular tools are also being used to determine the abundance and diversity of bacteria in samples from different counties and states.



Michelle R. Sanford

Major Professor: Drs. Jeffery K. Tomberlin and Jimmy K. Olson
Ph.D. Candidate

“The effect of unconditioned stimulus strength on associative learning in the southern house mosquito, *Culex quinquefasciatus* (Diptera: Culicidae).”

The southern house mosquito is an important disease vector worldwide, vectoring such disease agents as West Nile Virus and *Wuchereria bancrofti*. Associative learning capabilities with respect to appetitive behaviors were recently discovered in this mosquito species. This type of learning has interesting implications for disease transmission, particularly for those disease agents that rely upon repeated blood-meals to proliferate. The occurrence of associative learning in conjunction with sugar-meals suggests ecological significance and that mosquitoes are not merely “generalist nectar thieves”. Under the associative learning paradigm, an unconditioned stimulus, which elicits an unconditioned response, is paired with a conditioned stimulus over repeated trials to the point where the conditioned stimulus elicits the unconditioned response. In this study, the effect of unconditioned stimulus strength was examined by altering the concentration of sucrose used in the training assay. Sucrose solutions of 5, 10 and 50% were used to train mosquitoes to pure vanilla extract or myrcene. It was hypothesized that the higher the sugar concentration, the more effective training would be as it was tied to a higher quality resource. The effects of sugar concentration, multiple component odor stimulus (vanilla) versus pure odor stimulus (myrcene), and responses of males and females will be discussed.

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Bradley W. Hopkins

Major Professor: Dr. Patricia Pietrantonio
Ph.D. Candidate



“Pyrethroid resistance in the cotton bollworm, *Helicoverpa zea* (Boddie).”

The Heliiothine pest complex is comprised of the cotton bollworm, *Helicoverpa zea* Boddie, and the tobacco budworm, *Heliothis virescens* Fabricius. Heliiothines were the number one cotton pest in the United States in 2004 and caused a 1.23% reduction in yield. The aforementioned report indicated that the majority of this complex was composed of *H. zea* (94%), and almost half of the total bales lost were attributed to Texas.

Resistance to insecticides plays a key role in the pest status of these insects. In Texas, pyrethroids are commonly used in cotton and other cropping systems such as corn and grain sorghum for control of *H. zea*. Resistance to the pyrethroid, cypermethrin, has been monitored in *H. zea* using the adult vial test since 2000; and in 2004 and 2005, bollworm survival was found at the 60µg/vial concentration in Nueces County. The molecular mechanism of resistance is currently unknown, but it is likely that it can be attributed to target site insensitivity mechanism of resistance (kdr-like or super kdr-like) and/or increased metabolism by cytochrome P450 monooxygenases, esterases and other enzymes.

Research will be conducted to determine the mechanisms of resistance to pyrethroids in *H. zea*, the cypermethrin discriminating dosage for adult heterozygotes, and the correlation between pyrethroid resistance levels detected by the larval topical test and larvicidal field performance of sprayed cotton foliage.



Jillian Chantos

Major Professor: Dr. Bradley Vinson
M.S. Candidate

“Interactions between *Nedodusmetia sangwani*, the Rhodesgrass mealybug, *Antonina graminis*, and the red imported fire ant, *Solenopsis invicta*.”

The red imported fire ant, *Solenopsis invicta*, tends *Antonina graminis* for honeydew secretions. The honeydew appears important to the nutrition of *S. invicta* colonies. Control of *A. graminis* populations with the biological control agent, *Neodusmetia sangwani* may offer an approach to reduce *S. invicta* colony numbers. A greenhouse experiment containing four treatments varied by the presence or absence of *S. invicta* and *N. sangwani* was performed for two generations of *N. sangwani* to determine if *S. invicta* had an effect on the rate of parasitism of *A. graminis* by *N. sangwani*. Significant differences in the rate of parasitism of *A. graminis* by *N. sangwani* can be used to understand the impact of *S. invicta* in this tritrophic system and potential means of reducing colony numbers.

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Refugio Lomeli-Flores

Major Professor: Dr. Julio Bernal.

Ph.D. Candidate

“Host selection and plant effects on a monophagous insect: The case of coffee leafminer *Leucoptera coffeella* (Guérin-Ménéville) (Lepidoptera: Lyonetiidae).”

Chemical and physical mechanisms protect plants against herbivore damage. Some herbivores develop strategies to compensate or avoid the negative impact of such defenses. One strategy is to avoid plants with low nutritional or other negative characteristics for the offspring. Host selection becomes the key factor for herbivores that feed on enclosed structures. In this study, we explore the impact of coffee leaf quality on host selection, survival, developmental time, and the size of the coffee leafminer, *Leucoptera coffeella*. Non-choice experiments were conducted under laboratory conditions to assess the impact of nitrogen content, toughness, and percent dry weight of leaves in larval and size and survival of *L. coffeella*. We used the length of head capsule, width of the last larval instar, and adult hind tibia as size indices. Choice experiments were conducted to explore the effect of coffee leaf quality (size, age, nitrogen content and previous damage) on host selection. Results from the experiments showed that only leaf nitrogen content had a significant impact on *L. coffeella* survival and adult size. The results also showed that coffee leaf quality did not significantly effect host selection. It seems that *L. coffeella* females were not sensitive to host quality. These results support the hypothesis regarding the lower importance of host selection when factors other than plant resistance play a key role in population regulation. This could be the case for *L. coffeella* because of the high impact of natural enemies under field conditions, as found in previous studies.



Robert Puckett

Major Professor: Dr. Marvin Harris

Ph.D. Candidate

“Passive traps for monitoring *Pseudacteon* parasitoids of *Solenopsis* fire ants.”

Pseudacteon phorid flies that parasitize workers of *Solenopsis saevissima* complex fire ants (including the red imported fire ant, *S. invicta*) are being investigated as classical biological control agents for *S. invicta* in North America. Currently, fly presence is determined by direct observation of disturbed mounds or midden for appearance of flies, presumably attracted to chemical cues emanating from the materials. Field testing of a passive trap that exploits both the behavioral response of *Pseudacteon* phorids to *S. invicta* midden as well as the perching behavior of these flies shows this method is superior in operational efficiency and effectiveness relative to other techniques. Adult flies responding to deployed *S. invicta* midden are captured when they land on a Tanglefoot®-coated perch, which is part of the trap. This passive method provides a uniform, repeatable and verifiable sample that allows continuous and simultaneous sampling among locations, which can only be accomplished with other techniques by substantially increasing the number of observers. These traps have been shown to be effective in various phorid habitats in central Texas and will improve our ability to evaluate establishment following releases, detect expansion of phorid populations and obtain relative estimates of fly densities among locations and through time. We expect this trap to also be effective in detecting/monitoring phorid flies in other locations.

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Maggie Toothaker

Major Professor: Dr. Marvin Harris

M.S. Candidate

“Progress in evaluating converted cotton race stocks for resistance to whiteflies.”

Previous research indicated six of 116 cotton race stocks as showing some level of resistance to sucking insects, specifically whitefly (*Bemisia tabaci*), using an excised leaf technique as described by Ripple. Current research focusing on these six race stocks indicates intra-stock variation in resistance to whitefly is present. Our goal is to identify the best individual plants from the most promising race stocks by evaluating resistance to whitefly in whole plants. The best individual plants identified within each race stock will be used to make individual plant selections for further breeding and extension of this work from the laboratory into the field.



Takesha Henderson

Professor: Dr. Marvin Harris

M.S. Candidate

“Abundance, diversity, and distribution of ground spiders in Lick Creek Park in Texas.”

Lick Creek Park is a local nature park acquired in 1987 by the City of College Station, Texas. It is comprised of 515 acres. The site has a variety of indigenous plant and animal species and is an important natural resource for citizens of the region. Knowledge of its biodiversity provides enjoyment and education for present and future generations. There is a long-term commitment to inventory this natural park to monitor changes as our urban community expands to surround the park. Studies of spider diversity, ecology and phenology have been conducted in many countries. Spiders respond to temperature and water conditions so as to occupy favorable microhabitats most conducive for their survival. The ecology, phenology, and disposition of spiders is also important to agriculture. The precise effect of spider predation on a pest population will vary according to what other factors are influencing the rate of pest increase at that particular time. The focus of this research has improved the spider inventory by examining their diversity, abundance, and distribution at Lick Creek Park. There are 980 species currently recorded from Texas, with 335 from Brazos County. Reviewing previously collected material and small collections from spring 2004, 222 species are presently known from Lick Creek Park, with some new records for Brazos County, and for Texas. Little was known about the spiders at Lick Creek Park before the preliminary study in the spring of 2004. This inventory of spiders at Lick Creek has provided a basis for further studies on biodiversity and the assessment of human impact on the environment.

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Mark M. Johnsen
Major Professor: Dr. Jimmy Olson
Ph.D. Candidate

“The status of resistance in *Culex quinquefasciatus* Say (Diptera: Culicidae) populations in Harris County, Texas.”

In 2002, West Nile virus (WNV) was isolated for the first time in Harris County, Texas. The subsequent epidemic led the Mosquito Control Division of the Harris County Public Health and Environmental Services (HCPHES) Department to initiate an extensive spraying operation in an attempt to suppress infected adult mosquito populations. The control program was aimed at the predominate disease-carrying mosquito for the southern United States, the southern house mosquito, *Culex quinquefasciatus* Say.

With the increase of insecticide pressure on the mosquito populations, the possibility of resistance was brought into question. This study was conducted over a two-year period (2004-2005) to determine the resistance status of *Culex quinquefasciatus* to the six chemicals (malathion, dibrom, resmethrin, permethrin, sumithrin, and pyrethrum) used most frequently in adult mosquito control programs.

Harris County was determined to have localized pockets of resistance populations, but, on the whole, does not have widespread resistance in its mosquito population.



Christopher Jagge
Major Professor: Dr. Patricia Pietrantonio
Ph.D. Candidate

“Interfering with Diuretic Hormone (DH44) receptor expression in the mosquito *Aedes aegypti* (L).”

The female of the *Aedes aegypti* mosquito is the vector of yellow fever and dengue fever. No vaccine to prevent dengue fever or its associated syndromes has been developed. Dengue disease prevention and control depends on vector control. The efficacy of traditional insecticides for mosquito control continues to decline as mosquito populations in the USA and worldwide develop resistance. New pesticides with novel modes of action are urgently needed.

The pharmaceutical industry has successfully exploited "G Protein" –Coupled Receptors (GPCRs) as drug targets in human medicine. GPCRs in mosquitoes may hold promise as novel target sites in the development of unique mosquitocidal compounds. In this regard, hormone signaling tightly controls water excretion in blood feeding insects. Hormones released from the brain and other tissues in response to feeding activate GPCRs in the excretory system organs, transducing the signal across the cell membrane and activating effector proteins, such as water and ion channels, thus maintaining salt and water homeostasis. Understanding the physiological process of excretion signaled by these receptors will lead to the identification of synthetic agonists/antagonists --"lead" compounds in the discovery of additional insecticides.

Previously, I cloned the DH44 receptor cDNA from *Aedes aegypti* Malpighian tubules. I have determined the temporal expression pattern of the mRNA encoding this receptor in different life stages. Recently, by using RNA interference technology, I was able to decrease expression of the receptor mRNA in microinjected animals. Subsequent experiments will investigate the physiological effects resulting from decreased receptor transcript levels.

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Lizette Peters

Major Professor: Drs. Tanya Pankiw and Spencer Behmer
M.S. Candidate

“Nutritional Balance of honey bees”

Nutrition is the sum of processes by which one takes in and utilizes nutrients. Because *Apis mellifera*, the common honey bee, provides the most concentrated form of sugar in nature, there is a race to better provide for their needs and better cultivate honey. From the gathering of pollen to the feeding of brood, the nutritional needs of the honey bee are important. These needs as well as the *Nutritional Balance of the Honey Bee* will be covered giving a look into how the nutritional needs of the honey bee may apply to their feeding habits and touching briefly on whether honey bees are capable of eating a balanced meal.



Ji-Eun Ahn

Professor: Dr. Keyan Zhu-Salzman
Ph.D. Candidate

“Cowpea bruchid modulates propeptides of digestive proteases to cope with soybean cysteine protease inhibitor.”

Cowpea bruchids, when challenged by a soybean cysteine protease inhibitor (scN), reconfigure their major CmCP digestive proteases and recover normal feeding and development. Evidence previously indicated that insects selectively induced CmCPs from subfamily B that were most efficient in autoproducting and possessed not only high proteolytic, but also scN-degrading activity. However, dietary scN only marginally increased genes from the more predominant CmCP subfamily A that were inferior to subfamily B in these regards. To gain further molecular insight into this adaptive adjustment, we initiated domain swapping between the two respective subfamily members B1 and A16, the latter being unable to autoproduct nor degrade scN once transactivated. Swapping the propeptides did not qualitatively alter autoproducting in either protease isoform. However, swapping a domain leading to four amino acid changes in the A16 mature protein region upstream of C-25 (pAmBA) was sufficient to activate propeptide removal. Replacement of these amino acid residues to the corresponding B1 residues, singly and pair wise, revealed that activation of autoproducting in pAmBA resulted from cumulative and/or coordinated individual effects. Bacterially - expressed propeptides (pA16 and pB1) differed in their ability to inhibit the B1 mature enzyme. Lower inhibitory activity in pB1 is likely attributable to its lack of protein stability. This instability in the propeptide is necessary, although insufficient by itself, for scN-degradation by its mature enzyme. Taken together, cowpea bruchids modulate proteolysis of their digestive enzymes by controlling propeptide maturation and stability, which explains, at least in part, the plasticity cowpea bruchids demonstrate in response to protease inhibitors.

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Matt Yoder

Major Professor: Dr. Robert Wharton
Ph.D. Candidate

“MX, a database for systematic studies”

An overview of 'mx' (short for 'matrix'), a workbench which manages data used in various types of systematics-related studies, is provided. Its primary role is to assist practicing systematists in their day-to-day operations. Data pertaining to taxonomic names, images, references, biological associations, descriptions, specimens, morphological matrices, morphospecies and other data types are manageable via a web-based front-end. The workbench allows for multiple projects, each with multiple users to be instantiated, thus enabling efficient long range collaborations. Various ongoing projects which use mx are highlighted.

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